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ABSTRACT

The major consonant assimilation processes occurring in Classical and Colloquial Arabic are listed (classified as progressive or regressive, partial or complete), and an autosegmental analysis is performed on them. It is argued, on the basis of the autosegmental approach to the underlying representation of segments and to the application of phonological rules adopted in this paper, that partial and complete assimilation rules are just two forms of the same process since they apply in the same manner. Both types of assimilation involve the transfer of one or more features of a certain segment onto an adjacent one so that the latter becomes partially or totally like the former. The only difference between the assimilation types is found in their outcome, but this difference is not found to have any bearing on the behavior of the output of assimilation toward phonological rules like epenthesis. The analysis is then shown to be in harmony with the Obligatory Contour Principle concerning the phonological status of the geminate consonant clusters resulting from the phonological rules of assimilation. (MSE)

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CONSONANT ASSIMILATION IN ARABIC:

AN AUTOSEGMENTAL APPROACH

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Consonant assimilation in Arabic:
an autosegmental approach

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0. Introduction

This paper deals with a number of consonant-assimilation processes in Classical and Colloquial Arabic. Both types of assimilation, partial and complete, are considered in an attempt to arrive at a generalisation concerning their mode of application. It is argued, on the basis of the autosegmental approach to the underlying representation of segments and to the application of phonological rules adopted in this paper, that partial and complete assimilation rules are just two forms of the same process since they apply in the same fashion; both types of assimilation involve the transfer of one or more features of a certain segment onto an adjacent one so that the latter will become partially or totally similar to the former. The only difference between the two types of assimilation concerns their outcome: partial assimilation yields partially similar clusters whereas complete assimilation yields geminate clusters, although in some cases partial assimilation has the same result as that of complete assimilation. This difference, however, does not have any bearing on the behavior of the output of assimilation, partial or complete, towards phonological rules like epenthesis. In both cases, the derived cluster, whether geminate or nongeminate, does not undergo epenthesis although the segmental environment of the rule is met. This immunity against epenthesis is accounted for in a straightforward manner within the autosegmental framework adopted in this article. Finally, the analysis is shown to be in harmony with the Obligatory Contour Principle concerning the phonological status of the geminate consonant clusters that arise from the phonological rules of assimilation.

The paper is organized as follows: section 1 lists the major assimilatory processes that occur in Arabic. The processes are initially classified into regressive and progressive for organizational purposes. Then under each category the processes are organized into partial and complete. Section 2 provides an autosegmental analysis of assimilation where it is shown that partial and complete assimilation rules apply in the same fashion. Finally, in section 3, it is argued that this analysis of assimilation is in harmony with the Obligatory Contour Principle. To maintain this harmony in the case of partial assimilation, it is argued that partial assimilation involves the autosegmentalization of the feature or features involved in the assimilation process so that the assimilating and the assimilated consonants are now united in such a way that would prevent epenthesis from dissolving this union.

I. The assimilatory Processes

1. Regressive assimilation.

1.1. Partial assimilation.

1.1.1. Voicing.

This process turns a voiceless obstruent into voiced when it is followed by a voiced obstruent. It occurs in a number of Arabic dialects including Egyptian, Syrian and Libyan. The following examples from Egyptian Arabic illustrate this process.

- | | |
|----------------|------------------------|
| (1)a. sabaʔ-ni | "he arrived before me" |
| ʔi-sbaʔ-ni | "arrive before me!" |
| b. ʕabar | "he was patient" |
| bu-ʕbur | "he is patient" |
| c. kibīr | "great" |
| ʔaʕbar | "greater" |
| d. ʕabax | "he cooked" |
| maʕbax | "kitchen" |

This process is also operative across word boundary in Egyptian Arabic (Gary and Gamal Eldin 1982:127):

- | | |
|-------------------------|---------------------------|
| (2)a. ʔibnaʕ ga ʔinta → | |
| ʔibnaʕ ga ʔinta | "when did your son come?" |
| b. fiʕiʕ ʔaali → | |
| fiʕiʕ ʔaali | "expensive salted fish" |

In both Syrian and Libyan the voicing rule seems to be limited to certain morphological formatives, such as the t of the 6th verbal measure or the t of the feminine and second person of the imperfect indicative form of the 4th measure (Cowell 1964:86, 179, Owens 1984:46):

- | | |
|-----------------|--------------------------------|
| (3)a. d-zakkar | "to remember" (3 m. sg.) |
| (cf. t-saamah) | "to be forgiven" |
| b. bi-d-ʔiib | "to bring" (2 m. sg./3 f. sg.) |
| (cf. bi-t-ʕuuf) | "to see (2 m. sg./ 3 f. sg.)" |
| c. id-dabbih | |
| (< /it-dabbih/) | "you slaughter many" |

1.1.2. Devoicing.

This process, which devoices a consonant when it is immediately followed by a voiceless consonant, is also common in

Arabic. It operates in the dialects mentioned in 1.1.1. and also in Jordanian Arabic (Owens and Bani Yasin 1985) and Classical Arabic (Abdo 1983). The following examples from Syrian Arabic, for instance, will illustrate this process (Cowell 1964:26):

- (4) a. $\text{\textit{ʕtama}^Cu}$ (< / $\text{\textit{ʕtama}^Cu}$ /) "they gathered"
 (cf. $\text{\textit{ʕama}^C}$ "he gathered")
 b. $\text{\textit{ʔuutt}}$ in-noom "the bedroom"
 (< / $\text{\textit{ʔuudt}}$ in-noom/) (cf. $\text{\textit{ʔuuda}}$ "room")
 c. $\text{\textit{ʔaxatto}}$ "I took it"
 (< / $\text{\textit{ʔaxad-to}}$ /) (cf. $\text{\textit{ʔaxad}}$ "he took")

1.1.3. Nasal assimilation.

This process assimilates the nasal n to the point of articulation of a following bilabial. The nasal assimilation rule applies both word-internally and across word boundaries, and it operates in Classical Arabic and in many colloquial dialects as well. In the following examples from Classical Arabic, the characteristic n of the 7th measure optionally becomes m when it is followed by m (Wright 1977:65):

- (5) a. $\text{\textit{ʔin-maḥaqa}} \rightarrow \text{\textit{ʔim-maḥaqa}}$ "to be effaced"
 b. $\text{\textit{ʔin-maḥa}} \rightarrow \text{\textit{ʔim-maḥa}}$ "to be exterminated"
 c. $\text{\textit{ʔin-ma}^Caṭa} \rightarrow \text{\textit{ʔim-ma}^Caṭa}$ "to be torn out"
 d. $\text{\textit{ʔin-malasa}} \rightarrow \text{\textit{ʔim-malasa}}$ "to become smooth"

This rule is morphologically conditioned since it is limited to the morphological context indicated above.

- (6) a. $\text{\textit{ʔanmaṭ}} / * \text{\textit{ʔammaṭ}}$ "patterns"
 b. $\text{\textit{ʔanmaar}} / * \text{\textit{ʔammaar}}$ "tigers"

When the n is followed by b, the rule applies regardless of the morphological context.

- (7) a. $\text{\textit{ʔal-ʔanbiyaa}} \rightarrow \text{\textit{ʔal-ʔambiyya}}$ "the prophets"
 (cf. $\text{\textit{nabiy}}$ "prophet")
 b. $\text{\textit{ʔal-ʔanbaa}} \rightarrow \text{\textit{ʔal-ʔambaa}}$ "the news"
 (cf. $\text{\textit{naba}}$ "a piece of news")

In Libyan Arabic the nasal-assimilation rule has been extended so that the n also assimilates to the point of articulation of a following velar or labio-dental (Owens 1984:46):

- | | |
|--------------------------|-----------------------|
| (8) a. inkitab → inkitaḅ | "it (m.) was written" |
| b. ingaṣaṣ → iŋgaṣaṣ | "he was deceived" |
| c. inguulu → iŋguulu | "we say" |
| d. imbina → imbina | "it was built" |
| e. infattiḥ → iŋfattiḥ | "I look for" |

1.2. Complete assimilation rules.

1.2.1. Definite-article assimilation.

This process is quite common in Arabic. It applies in all Arabic dialects as well as in Classical Arabic (Wright 1977, Cowell 1964, Broselow 1976, Owens 1984, Owens and Bani Yasin 1985). The main function of this rule is to completely assimilate the definite article l to any following [+coronal] consonant, as the following examples from Syrian show (Cowell 1964:493):

- | | |
|-----------------|-----------------|
| (9) a. ṣ-ṣaff | "the row" |
| b. t-taalit | "the third" |
| c. ṣ-ṣooraba | "the soup" |
| d. s-smiike | "the thick" |
| e. ṣ-ṣasim | "the drawing" |
| f. d-daḥiḥ | "the fine" |
| g. l-lhaaf | "the quilt" |
| h. ṣ-ṣamīl | "the pretty" |
| i. t-taalib | "the student" |
| j. s-saki | "the bright" |
| k. ṣ-ṣaabit | "the officer" |
| l. d-daḥuuk | "the jolly" |
| m. n-nabaatiyye | "the vegetable" |
| (10) a. l-walad | "the boy" |
| b. l-bint | "the girl" |
| c. l-Calam | "the flag" |
| d. l-ḥalam | "the pencil" |
| e. l-faras | "the horse" |

- | | |
|-------------------------|------------|
| f. l-ka ^c ib | "the heel" |
| g. l-malik | "the king" |

In Syrian the rule seems to be optional before the consonant ʕ; one may sometimes hear, for instance, l-ʕibne "the cheese" instead of f-ʕibne.

In Egyptian the environment of the definite article assimilation rule has been extended to include velar stops (Gary and G. Eldin 1982:127):

- | | |
|-----------------|--------------|
| (11)a. k-kalaam | "the speech" |
| b. k-koora | "the ball" |
| c. g-gidiid | "the new" |
| d. g-goon | "the goal" |

In Classical Arabic the rule was extended to the consonant l in words like hal (interrogative particle) and hal "even, but," when it is followed by r (Wright 1977:15):

- | | |
|----------------------|----------------|
| (12)a. hal-raʔayta → | |
| har raʔayta | "Did you see?" |

1.2.2. t-assimilation.

The formative t, which stands for the second masculine singular or the third feminine singular subject, is completely assimilated to a following (+ coronal) obstruent in a number of colloquial Arabic dialects, including Egyptian, Jordanian, and Syrian.

- | | |
|------------------|------------------|
| (13)a. bi-s-siid | "to increase" |
| b. bi-ʕ-ʕiib | "to bring" |
| c. bi-ʕ-ʕuuf | "to see" |
| d. bi-ʕ-ʕubb | "to pour" |
| e. bi-d-dall | "to remain/stay" |
| f. bi-d-diss | "to insert" |
| (14)a. bi-t-limm | "to collect" |
| b. bi-t-ʕiiʔ | "to wake up" |
| c. bi-t-ruuʕ | "to go" |

This rule, like the definite-article assimilation rule, has also been extended in Egyptian Arabic to apply before velar stops (Gary and Gamal El-din 1982:127):

- (15)a. ʔit-gawwiz → ʔig-gawwiz "he got married"
 b. ʔit-kallim → ʔik-kallim "he spoke"

The rule has also been extended to apply to other t's in Egyptian:

- (16)a. sa^Cat kitiira → sa^Cak kitiira "many watches"
 b. ʔagat gamiila → ʔagag gamiila "beautiful things"

1.2.3. Nasal assimilation.

In Classical Arabic the nasal consonant n is completely assimilated to a following glide or liquid (Wright 1977:15):

- (17)a. ʔan yaqtulu → ʔay yaqtulu
 b. ʔinwahab → ʔiwahab
 c. min laylin → millaylin
 d. min rabbihi → mir rabbihi

In addition, n is realized as m when followed by m (Wright 1977:65):

- (18)a. kitaabun mubiinun → kitaabum mubiinun
 b. min ma → min ma
 c. ʔan ma → ʔam ma
 d. ʔinmahaga → ʔimmahaga
 e. ʔinmaḥa → ʔimmaḥa

The same process is observed in some colloquial dialects like Syrian (Cowell 1964:27,179) as in ʔaḥsallak (</ʔaḥsanlak/) "better for you" or r-raḥ (</n-raḥ/) "if he goes," Libyan (Owens 1984:46) as in ir-riid (</in-riid/) "I want" or illi^Cab (</inli^Cab/) "it was played," and Jordanian (Owens and Bani Yasin 1985:4) as in ir-rabat (</in-rabat/) "he tied up" or immasak (</in-masak/) "be caught."

1.2.4. Glide assimilation.

This process, which most commonly occurs in Classical Arabic, assimilates the glides y and w to a following t. It is morphologically conditioned as it applies only in certain morphological contexts. For instance, in the 8th verbal conjugation, w and y are assimilated to the characteristic t of that conjugation, thus producing tt for wt or yt (Wright 1977:80):

- (19) a. ʔiytaCada)
 ʔiwtaCada) → ʔittaCada "to receive a promise"
 b. ʔiytasara)¹
 ʔiwtasara) → ʔittasara "to play at hazard"

1.2.5. Dental assimilation.

In Classical Arabic the dentals ʔ, d, ɗ, ɗ̣, t, and ɗ̣ are completely assimilated to a following t in certain parts of the verb (Wright 1977:16):

- (20) a. labiʔtu → labittu
 b. ʔaradta → ʔaratta
 c. ʔattaxadtum → ʔattaxattum
 d. basattum → basattum

1.2.6. Other assimilatory processes.

The following two rules that apply in Jordanian Arabic are reported in Owens and Bani Yasin (1985:6). The first assimilates the consonant l to a following n:

- (21) a. gulna → gunna "we said"
 b. jaabilni → jaabinni "he brought (for) me"
 c. ʔaalna → ʔaanna "ourselves"
 d. miʔilna → miʔinna "like us"

The second rule assimilates the voiced stop g to a following n.

- (22) a. ʕind-na → ʕinna "at us"
 b. bidd-na → binna "we want/must"

2. Progressive assimilation.

2.1. Partial assimilation.

2.1.1. Velarisation.

The characteristic t of the 8th conjugation of the verb in Classical Arabic becomes emphatic ṭ if the first root consonant is emphatic (Wright 1977:67):

- (23) a. ʔiʔtabara → ʔiʔ̣tabara (root = ʔ - b - r)
 b. ʔiʔtarada → ʔiʔ̣tarada (" = ʔ - r - d)
 c. ʔiʔtalama → ʔiʔ̣talama (" = ʔ - l - m)
 d. ʔiʔtaʔaʕa → ʔiʔ̣taʔaʕa (" = ʔ - ʃ - ʕ)

2.1.2. /ʔ/-assimilation.

The glottal stop in Classical Arabic is optionally changed into the glide w or y if preceded by the high vowel u or i, respectively, and followed by a or aa (Wright 1977:18):

- (24) a. ʃuʔan → ʃuwan
 b. suʔaal → suwaal
 c. miʔa → miya
 d. liʔaam → liyaam

In cases where /ʔ/ is preceded by uu, ii, or ai, it becomes w or y whatever be the following vowel:

- (25) a. maqrūuʔa → maqrūuwa (→ maqrūwva)
 b. nabīiʔu → nabīiyu (→ nabīyyu)
 c. faiʔin → faiyin (→ fayyin)

In other words, the stem-final /ʔ/ assimilates to the roundness properties of the preceding high vowel in the contexts mentioned above, thus becoming y or w.

2.1.3. Voicing assimilation.

The characteristic t of the 8th verbal conjugation in Classical Arabic is voiced if preceded by d or z (Wright 1977:66):

- (26) a. ʔistaʔara → ʔisdaʔara (root = z - ʕ - r)
 b. ʔistaada → ʔisdaada (" = z - w - d)
 c. ʔidtakara → ʔiddakara (" = d - k - r)
 d. ʔidta^Ca → ʔidda^Ca (" = d - ^C - y)

That is, when the first root consonant is voiced z or d, the infix t in the 8th verbal conjugation becomes voiced.

This same process is also operative in the same context in colloquial dialects like Syrian (Cowell 1964:100):

- (27) a. zdaad "to increase" (root = z - w - d)
 b. zdara "to scorn" (" = z - r - y)
 c. dda^Ca "to claim" (" = d - ^C - y)
 vs. d. ftara "to lie/fabricate" (" = f - r - y)
 e. ftara "to buy" (" = ʕ - r - y)
 f. stawa "to ripen" (" = s - t - w)

2.2. Complete assimilation.

2.2.1. ʔ-assimilation.

The glottal stop in Classical Arabic may change into the glide y if preceded by the glide y (Wright 1977:18):

- (28) a. $\text{\$ay?in} \rightarrow \text{\$ayyin}$ "something (gen.)"
 b. $\text{\$ay?an} \rightarrow \text{\$ayyan}$ "something (accus.)"

It may also change into a vowel homogeneous with the preceding vowel when it is followed by a consonant:

- (29) a. $\text{ra?s} \rightarrow \text{raas}$ "head"
 b. $\text{lo?m} \rightarrow \text{loom}$ "meanness"
 c. $\text{bi?r} \rightarrow \text{biir}$ "well"

2.2.2. Glide assimilation.

The glide w or y in Classical Arabic may change into a vowel homogeneous with the preceding vowel (Abdo 1983:207):

- (30) a. $\text{miwzaan} \rightarrow \text{miizaan}$ "scale"
 b. $\text{muyqin} \rightarrow \text{muuqin}$ "sure"

2.2.3. h-assimilation.

/h/ in Libyan Arabic is completely assimilated to a preceding voiceless sound if the sound is non-geminate

(Owens 1984:46):

- (31) a. $\text{\$ok-ha} \rightarrow \text{\$ok-ka}$ "its (f.) thorns"
 b. $\text{\$ifit-hum} \rightarrow \text{\$ifit-tum}$ "I saw them (m.)"
 c. $\text{\$amis-ha} \rightarrow \text{\$amis-sa}$ "its sun"
 vs. d. $\text{daff-ha} \rightarrow \text{*daff-fa}$ "he pushed it (f.)"

The same rule also applies in Jordanian Arabic (Owens and Bani Yasin 1985:5):

- (32) a. $\text{binit-hum} \rightarrow \text{binit-tum}$ "their (m.) daughter"
 b. $\text{\$aaf-hin} \rightarrow \text{\$aaf-fin}$ "he saw them (f.)"

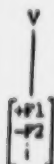
II. Analysis.

The present analysis of consonant assimilation in Arabic is based on the autosegmental approach to the representation of sounds at the underlying level as put forward in Goldsmith (1976) and Clements (1976) and as further enriched and expanded to account for non-tonal phenomena in works such as McCarthy (1979, 1981, 1982), Halle and Vergnaud (1980, 1981), Leben (1980), and more recently in Clements and Keyser (1983). It is generally held

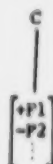
that sounds at the underlying level are defined in terms of unordered sets of specified features, each sound being represented in the form of a matrix of distinctive features having specified values. This layer of distinctive feature matrices is commonly referred to as the segmental tier. This tier is linked by means of association lines to another tier called the CV-tier whose vocabulary consists solely of C and V elements. The CV-tier mediates between the segmental tier and a third tier called the syllable tier whose vocabulary consists merely of the single element σ (for more details about these tiers and others, see Clements and Keyser 1983). For purposes of this study, I will focus on just two tiers, the segmental tier and the CV-tier, since the other tiers are not directly relevant to the present analysis.

Short segments, within this framework, are given the following representations where a single feature matrix is linked to just one element of the CV-tier:

(33)a. short vowel

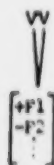


b. short consonant

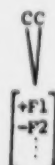


Long segments, on the other hand, have the following representations where a feature matrix is associated with two identical and adjacent elements of the CV-tier (Laden 1980):

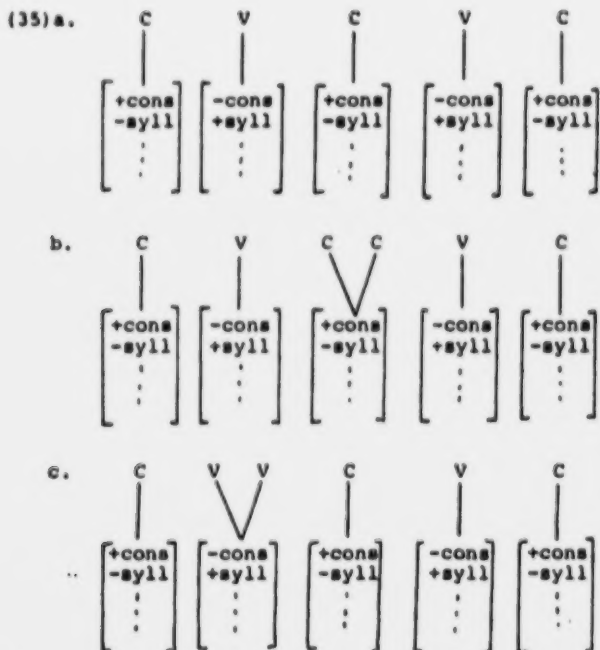
(34)a. long vowel



b. long consonant



Consequently, words like katab 'he wrote', kattab 'he made (someone) write', and kaatab 'he corresponded' will have the following partial underlying representations, respectively:



One of the advantages of this multi-tiered approach to the underlying representations of utterances is that it enables us to account for certain phonological phenomena in a straightforward manner; it also simplifies the statement of certain phonological rules. For instance, there is an epenthesis rule in Arabic that breaks up consonant clusters by inserting a high front vowel within the cluster. In Palestinian Arabic, for example, a word-final two-consonant cluster is broken up by

inserting the vowel /i/ between the two members of the cluster. In three-consonant clusters the vowel is inserted before the last two consonants (Brame 1974:41):

- | | |
|-------------------------|-------------|
| (36)a. katab <u>i</u> t | 'I wrote' |
| b. ʔalab <u>i</u> t | 'I ordered' |
| c. ʔabi <u>i</u> na | 'before us' |
| d. ʔibi <u>i</u> na | 'our ink' |

However, when the consonant cluster consists of or includes two contiguous identical consonants, epenthesis does not apply:

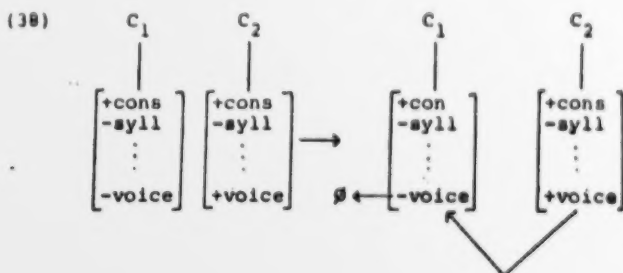
- | | |
|--------------------------|--------------------------|
| (37)a. ʔimma / *ʔimim | 'mother' |
| b. ʔimm-na / *ʔimim-na | 'our mother' |
| c. sitt / *sitit | 'grandmother' |
| d. sitt-kum / *sitit-kum | 'your (pl.) grandmother' |

To ensure that epenthesis does not apply to such geminate clusters, Brame offers two possible proposals. The first is to add a condition to the statement of the rule so as to exclude such clusters from the epenthesis domain, and the second is to add a general rule of gemination to the grammar so as to turn clusters of two identical consonants into single geminate or long consonants. He adopts the second alternative, although he says that both analyses are possible.

The multi-tiered approach to the underlying representation of sounds accounts satisfactorily for these two points. First, no condition will be added to the statement of the epenthesis rule since the rule will automatically not apply to the geminate or long consonant due to its representation by a single feature matrix on the segmental tier; the rule will only apply to clusters of consonantal feature matrices. Second, no additional rule of gemination will be added to the grammar since there are no sequences of identical matrices on the segmental tier; the

grammar of Arabic is thus simpler under the multi-tiered analysis than a grammar having one more rule since it achieves what the second grammar does without having that extra rule.

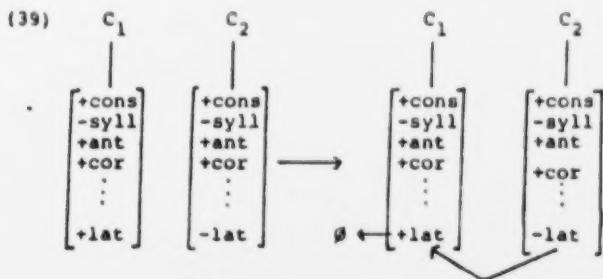
Given this approach to the underlying structure of utterances, we can now discuss the consonant-assimilation procedure. As mentioned earlier, partial assimilation processes involve transferring one or more features of a segment onto the feature matrix of an adjacent segment so that the former segment will become partially similar to the latter. The transfer of any particular feature from one matrix onto another implies, of course, that the feature in question in the affected matrix is deleted before or simultaneously with the process of copying the same feature of the controlling matrix with its specified value. Regressive voicing, for instance, requires substituting the feature [+voice] for the feature [-voice] when the segment specified for the latter feature is immediately followed by a voiced obstruent. All the remaining features of the assimilated segment remain intact. This process can be formally represented as follows:



That is, the feature [+voice] of C_2 is extended to the preceding matrix and, as a result, the feature [-voice] of C_1 is deleted.

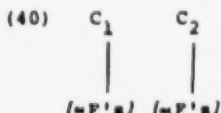
Complete assimilation processes are accounted for in a similar way. Initially one may think that complete assimilation is different from partial assimilation in the number of features involved in the assimilation process, in the sense that complete

assimilation involves changing more features than in the case of partial assimilation. This, however, is not always the case. There are cases where partial assimilation involves changing more features than in the case of complete assimilatory processes. Consider, for instance, the complete assimilation of the definite article /l/ to a following /r/ in contrast with the partial assimilation of /n/ to a following velar. Given the SPE system of distinctive features, /l/ and /r/ differ only in the feature (+lateral): /l/ is (+lateral) whereas /r/ is (-lateral). Thus the assimilation of /l/ to /r/ will just involve replacing the feature (+lateral) in the feature matrix of /l/ by the feature (-lateral). The partial assimilation of /n/ to /ŋ/ before velars, on the other hand, will involve changing at least four features in the feature matrix of /n/: the features (-high), (-back), (+anterior), and (+coronal) are changed to (+high), (+back), (-anterior), and (-coronal), respectively. It is clear then that complete and partial assimilation rules are basically similar, and that they are achieved by the same mechanism that extends certain features of one feature matrix onto a neighboring matrix. The complete assimilation of /l/ to /r/ will consequently be similar to the partial assimilation in (38):



However, partial and complete assimilation rules differ in just one point, i.e., their outcome. Generally, partial assimilation results in consonant clusters having some features in common; complete assimilation, on the other hand, results in clusters of identical consonants. These identical consonant

clusters will have the following representations after the complete assimilation rules have applied:



The questions that arise at this point pertain to the status of the derived representation in (40) and whether it is different from the representation of geminate or long consonants in (34b), and if this difference is motivated by any phonological processes. The answer to these queries is negative. We have seen earlier that geminate consonant clusters are immune to epenthesis, and that the representation of underlying length in (34) accounts neatly for this immunity. The derived geminate consonant clusters are also immune to epenthesis, as shown by the following examples:

- (41)a. ?a^{CC}att / *?a^{CC}atit
(*/*?a^{CC}ad-t/*)* 'I seated (someone)'
b. ?a^{CC}atthum 'I seated them'
c. *?a^{CC}atithum
d. ?a^{CC}adithum

In (41a) the stem-final consonant d assimilates the voicing property of the suffix t so that a geminate cluster tt is derived. This geminate cluster remains intact as evidenced by the starred form in (41a), and it does so when the consonant-initial suffix -hum is added in (41b). When this cluster is broken up by the epenthetic vowel /i/, the result is the incorrect form in (41c). But when epenthesis applies before assimilation, the result is the acceptable form in (41d) which is now immune to assimilation since the two consonants /d/ and /t/ are no longer contiguous.

This parallel behavior of underlying and derived geminate consonant clusters with respect to the epenthesis rule suggests that the two types of clusters should have identical representations when epenthesis comes to apply. This is achieved by having a general rule in the grammar of Arabic to collapse sequences of contiguous identical consonants into single long consonants whenever they arise in the phonological derivation (Brame 1974, Abu-Salim 1980). In the present approach to the representation of utterances, this rule is realized in two steps (cf. Ingria 1980, Kenstowicz 1982). First, the derived geminate cluster undergoes a segmental rule of degemination whereby one member of the cluster is deleted. This rule results in having a C element on the CV-tier unassociated with any feature matrix, as shown by the formulation of the degemination rule below:

$$(42) \quad \begin{array}{ccc} C & & C \\ | & & | \\ \langle \text{P}'s \rangle & & \langle \text{P}'s \rangle \end{array} \longrightarrow \begin{array}{cc} C & C \\ & | \\ & \langle \text{P}'s \rangle \end{array}$$

Second, the resulting structure is corrected by linking the unassociated C to the feature matrix associated with the following C. This linkage is necessitated by one of the well-formedness conditions (WFC) of the autosegmental theory whereby the elements of one tier must all be associated with elements of the neighboring tier. This will give the following realization for the output of rule (42):

$$(43) \quad \begin{array}{ccc} C & & C \\ & \diagdown & \diagup \\ & & \langle \text{P}'s \rangle \end{array}$$

To see how this analysis works, consider the derivation of examples like š-šams (ʔ/1-šams/) 'the sun':

(44)

C	C	V	C	C ^h
l	h	a	m	s

a) underlying structure

C	C	V	C	C
h	h	a	m	s

b) definite-article ass.

C	C	V	C	C
h	a	m	s	

c) degemination

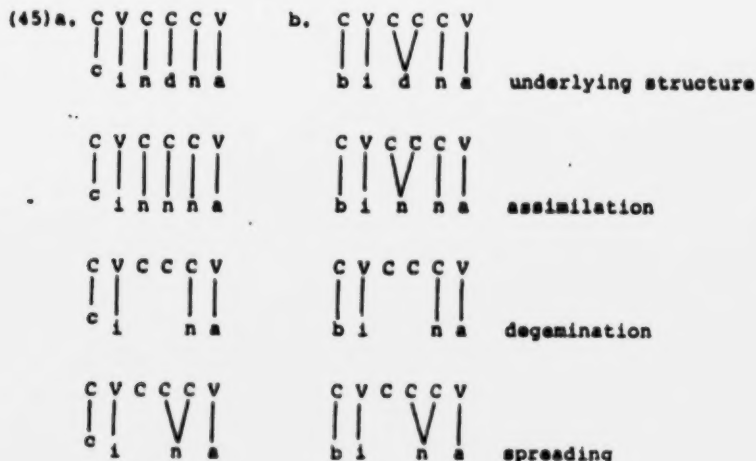
C	C	V	C	C
↙				
h	a	m	s	

d) WPC (= spreading)

To sum up, we have seen that this multi-tiered analysis of assimilation accounts neatly for the parallel behavior of underlying and derived geminate consonant clusters by assigning them the same structural representation that phonological rules like epenthesis refer to.

This multi-tiered analysis also accounts for the inapplicability of assimilation in words like daff-ha (3ld). The sound /h/ fails to assimilate to the preceding voiceless sound because the latter is long. This is due to the unavailability of a three-way length contrast in Arabic sounds. Consonants and vowels are either short or long; there are no overlong segments. Consequently, there are no cases where one feature matrix is associated with three or more positions on the CV-tier. This is accounted for by imposing a constraint on phonological representations prohibiting the association of one feature matrix with more than two positions on the CV-tier.

Evidence for this constraint is provided by examples such as (22a,b). The output of assimilation in these examples is expected to be *cinnna* and *binnnna* with an overlong n, but the actual output is *cinna* and *binna* with a simple long n. There may be some disagreement on the proper analysis of these examples (cf. *cinnidna* / **cinninna* with an epenthetic vowel before d and with no assimilation, and *bid-na* / *bin-na* with a short d before the suffix -na in some varieties of Jordanian and Palestinian Arabic). But given these words as they are reported above, the grammar of Arabic would involve a convention, possibly universal, as part of the word-structure building mechanism to delete any slot on the CV-tier that is left unassociated with any feature matrix on the segmental tier after the association between the two tiers is performed following degemination. The basic function of this convention concerning assimilation is thus to maintain the constraint mentioned above. The derivation of *cinna* and *binna* would consequently proceed as follows:





When assimilation applies in (45a), the sound d becomes identical with the surrounding consonants, so that a three-consonant geminate cluster is created. Degemination applies, deleting iteratively the first two feature matrices of the cluster. This is followed by linking the remaining feature matrix of the cluster with the closest unassociated C slot. No further linking is allowed because of the constraint mentioned above, so that the initial C of the cluster is left unassociated. This situation invokes the deletion convention, thus the stranded C is deleted, which gives us the correct output ²inna. The same process is performed in (45b) to give us the correct output binna.

III. Assimilation and the Obligatory Contour Principle (OCP)

We have seen in the preceding section that the geminate consonant clusters that arise from the phonological rules of assimilation are transformed into long consonants having the same representation as that of the underlying long consonant. This is motivated, as argued above, by the parallel behavior of underlying and derived long consonants regarding epenthesis. This analysis is in harmony with Leben's (1980:507) extension of the OCP whereby sequences of identical segments are automatically transformed, when they arise at any stage in the phonological derivation, into single segments on the segmental tier associated with two contiguous identical positions on the CV-tier (i.e., the representations in (34) above).

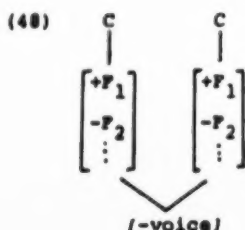
It is interesting to notice that the spirit of the OCP is also observed in the case of partial assimilation. Consonant clusters that are usually dissolved by epenthetic vowels remain intact if any member of the cluster undergoes a partial assimilation rule, thus acquiring one or more features of the other member of the cluster, as illustrated by the following examples, where the epenthetic vowel is underlined:

- (46) a. sabit 'Saturday'
 b. sapt
 c. *sapit
- (47) a. l-ʔudi 'Jerusalem'
 b. l-ʔus
 c. *l-ʔuti

The (a) examples show that the final consonant cluster is broken up by the epenthetic vowel /i/. Since epenthesis is optional in these examples, the rule may not apply, which creates the proper environment for the regressive devoicing rule. This rule will devoice the first member of the cluster under the influence of the following voiceless sound. Once this devoicing has taken place, the epenthesis rule will no longer have a chance to apply to the final consonant cluster, as evidenced by the unacceptable (c) forms.

This immunity of the (b) forms in (46-47) to epenthesis may be explained in a straightforward manner within the framework adopted in this article. We have seen in the preceding section that when two adjacent feature matrices become identical as a result of assimilation, one matrix is generalized by linking it to the two corresponding C positions on the CV-tier after deleting the second matrix. In a similar fashion, when a segment undergoes partial assimilation so that it becomes partially identical with

a neighboring segment, the feature or features involved in the assimilation process are autosegmentalized and linked to both feature matrices. The final consonant cluster in the (b) examples in (46-47) above will consequently have the following structure after assimilation has applied:



This autosegmentalization of the feature $[-\text{voice}]$ and its subsequent linking with the two feature matrices will now protect the consonant cluster against epenthesis and save the effects of assimilation which would otherwise be undone if epenthesis were to apply. In other words, the two feature matrices are now united by the feature $[-\text{voice}]$, and this union, as in the case of long consonants, is not subject to dissolution by the epenthesis rule.

The autosegmentalization of features described above is not to be understood as a process by which the features common to two adjacent matrices are factored out and treated as autosegments associated with both matrices; it is limited to just those features that are involved in the assimilation process. The following examples show that voiceless or voiced consonant clusters that do not undergo assimilation are not immune to epenthesis:

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(49)a. tax <u>i</u> t	'bed'
b. ta <u>h</u> i <u>t</u>	'below'
c. ʔi <u>b</u> i <u>n</u>	'son'
d. ba <u>y</u> i <u>l</u>	'mule'
e. ʔa <u>m</u> i <u>n</u>	'security'

To sum up, we have seen that partial and complete assimilation rules apply in the same fashion. Both involve the generalization of some or all features of the assimilating segment so that this segment and the assimilated one will come to share those features. In complete assimilation, this is realized by applying a segmental rule of degemination after assimilation, deleting one feature matrix and then associating the remaining matrix of the cluster with the two corresponding C positions on the CV-tier. In partial assimilation, on the other hand, the triggering features of the assimilating segment are autosegmentalized and linked to the feature matrices of the assimilating and assimilated segments. This is motivated by the behavior of the output of both types of assimilation towards epenthesis.

References

- Abdo, D. 1983. "Taṣṭartīb fi taṭbiq ilqawaa^Cid issawṭiyya fi llugat il^Carabiyya" ("Rule ordering in the application of phonological rules in Arabic"), in Tallisaaniyyaat fi xidmat illugat il^Carabiyya ("Linguistics in the service of the Arabic language"), Social and Economic Studies and Research Center, Tunis.
- Abu-Salim, I. 1980. "Epenthesis and Geminate Consonants in Palestinian Arabic," Studies in the Linguistic Sciences, 10.2: 1-11, University of Illinois, Urbana.
- Brame, M. 1974. "The Cycle in Phonology: Stress in Palestinian, Maltese, and Spanish," Linguistic Inquiry, 5.1: 39-60.
- Chomsky, N. and M. Halle. 1968. The Sound Pattern of English. New York: Harper and Row.
- Clements, G. 1976. Vowel Harmony in Nonlinear Generative Phonology: an autosegmental model. Published in 1980 by Indiana University Linguistics Club.
- _____ and S. J. Keyser. 1983. CV Phonology: A Generative Theory of the Syllable. Linguistic Inquiry Monographs No. 9. Cambridge, Mass.: The MIT Press.
- Cowel, M. W. 1964. A Reference Grammar of Syrian Arabic. Washington, D.C.: Georgetown University Press.
- Gary, J. O., and S. Jamal-Eldin. 1982. Cairene Egyptian Colloquial Arabic. Lingua Descriptive Studies, Vol. 6. Amsterdam: North-Holland Publishing Company.
- Goldsmith, J. 1976. Autosegmental Phonology. MIT doctoral dissertation. Distributed by IULC, Bloomington.
- Halle, M., and J.-R. Vergnaud. 1980. "Three Dimensional Phonology," Journal of Linguistic Research 1, 83-105.
- _____. 1981. "Harmony Processes," in Klein and Levelt, eds., (1981).
- Ingrā, R. 1980. "Compensatory Lengthening as a Metrical Phenomenon," Linguistic Inquiry 11.3:465-495.
- Kenstowicz, M. 1982. "Gemination and Spirantization in Tigrinya," Studies in the Linguistic Sciences 12.1:103-122, University of Illinois, Urbana.

- Klein, W., and W. Levelt, eds. 1981. Crossing the Boundaries in Linguistics: Studies Presented to Manfred Bierwisch, Reidel, Dordrecht.
- Leban, W. 1980. "A Metrical Analysis of Length," Linguistic Inquiry 11.3: 497-509.
- McCarthy, J. 1979. Formal Problems in Semitic Phonology and Morphology. MIT doctoral dissertation, Cambridge, Mass.
- _____. 1981. "A Prosodic Theory of Nonconcatenative Morphology," Linguistic Inquiry 12, 373-418.
- _____. 1982. "Prosodic Templates, Morphemic Templates, and Morphemic Tiers," in van der Hulst and Smith, eds., (1982), Vol. 1.
- Owens, J. 1984. A Short Reference Grammar of Eastern Libyan Arabic. Wiesbaden: Otto Harrassowitz.
- _____. and R. Bani Yasin. 1985. "The Phonology of a Northern Jordanian Arabic Dialect," manuscript, Yarmouk University, Irbid, Jordan.
- van der Hulst, H., and H. Smith, eds. 1982. The Structure of Phonological Representations (Part 1), Foris, Dordrecht.
- Wright, W. 1977. A Grammar of the Arabic Language. Cambridge: Cambridge University Press.